



## Owner's Manual

**SEGA/Gremlin**

Manual Part No.  
420-0613



OPERATING INSTRUCTIONS

AND

SERVICE MANUAL

MANUFACTURED BY

SEGA/GREMLIN  
TLX 910-335-1621

BORDERLINE OWNER'S MANUAL

Copyright - 1981 by SEGA/Gremlin, All Rights Reserved

## INTRODUCTION

BORDERLINE is an electronic game that makes extensive use of digital integrated circuitry and television monitor concepts. This manual is designed for the maintenance technician who possesses a general knowledge of solid state circuitry, microprocessor and digital integrated circuitry and TV monitor concepts. Any individual not knowledgeable in these areas should not attempt repair of the electronic portion of the game. If you have any questions not answered in this manual, call SEGA/Gremlin Customer Service, 800-854-1098.

## GAME SET-UP AND INSPECTION

### 1. Inspection

Before plugging in your new game, inspect it closely to spot any possible shipping damage. Check to ensure the graphics are in place, the monitor is not damaged and that the overall cabinet is in good condition. Open the rear access panel and inspect the inside of the game. Be sure no components or connectors have come loose. Proper connector fittings must be checked before game power is applied. Check all related connectors for good contact. Although disconnected are easily spotted, poor contacts are difficult to locate. The connectors should therefore be pushed in firmly and then loosened to spot poor connections. Check to ensure the fuses are intact. There are three fuses (not counting the monitor fuses). They are located on the power supply.

### 2. Important Notes

The following note is included in compliance with FCC rules:

WARNING: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulations, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 FCC Rules, which are designed to provide reasonable protection against interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

### 3. Miscellaneous

NEVER remove circuit board connections while the power is on.

NEVER replace any components with anything other than exact replacement parts.

DO NOT replace fuses with anything other than proper value. A blown fuse indicates an overload condition within the game. Replacing the fuse with a higher value can cause damage to internal components, if an overload occurs.

CORRESPONDENCE regarding this game should be addressed to:

SEGA/Gremlin  
8401 Aero Drive  
San Diego, California 92123  
Attn: Customer Service  
(800) 854-1098

## GAME CONCEPT

**BORDERLINE** is a one or two player game in which players attempt to destroy enemy refineries and energy plants. The player moves through four different sectors, constantly under attack by enemy tanks, missiles, interceptors and drones.

### Sector 1

The player is deep behind enemy lines, rolling his jeep down a corridor. He must dodge fire from interceptors, tanks and missiles. Drones will attack unexpectedly. The object is to reach and destroy the energy plants at the end of the corridor.

### Sector 2

Once through the corridor, the player enters a field that contains two sections of dense underbrush patrolled by drones. The drones will only enter the underbrush in one place, then follow in the path the player's jeep makes. The player must make a maze through the underbrush and proceed to the top and destroy the energy plants.

### Sector 3

In this sector, enemy tanks come down from the top, near the refineries, and drones enter from the side. The player must outmaneuver the enemy and destroy the refineries at the top.

### Sector 4

Again, there are two sections of underbrush, this time separated by walls. Drones enter from the sides. They will break the wall once, but not twice and will follow in the path made by the player's jeep. In the upper section of underbrush, is the energy plant. This time protected by revolving armament, in addition to tanks. The object is to destroy the energy base. Players alternate at the destruction of each jeep. The game ends when all jeeps are destroyed.

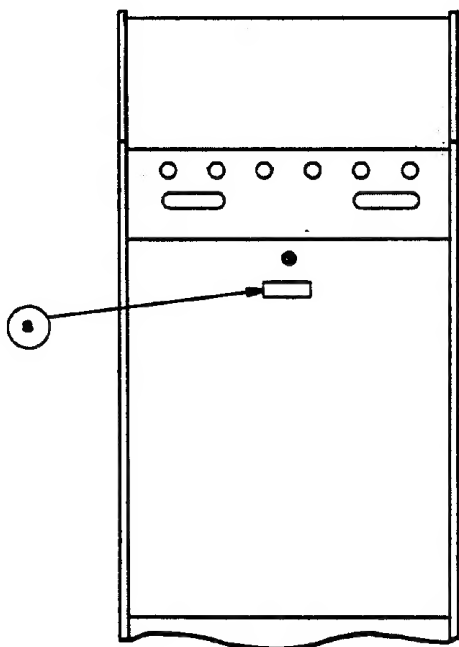
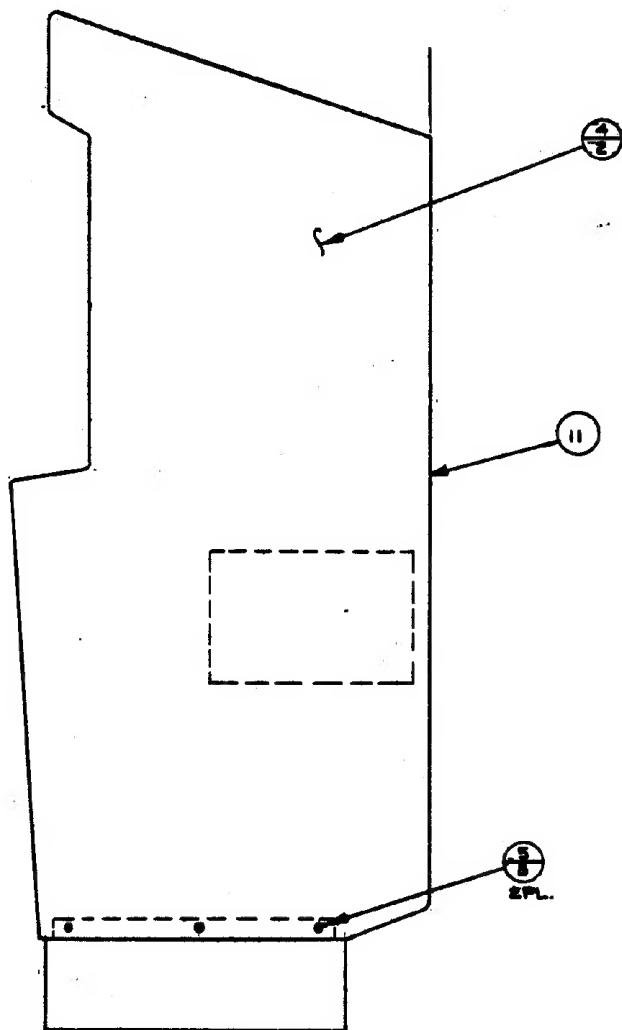
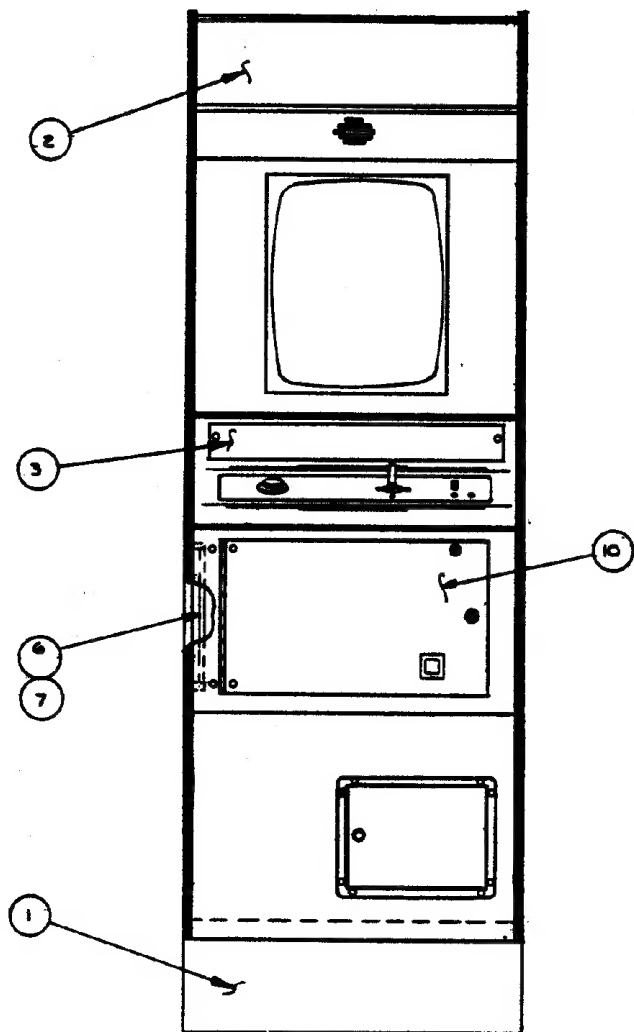
# BORDERLINE OPTIONS SELECTION

OPTION	SWITCH	1	2	3	4	5	6	7	8
3 Jeeps		On	Off	Off	X	X	X	X	X
4 Jeeps		Off	On	Off	X	X	X	X	X
5 Jeeps		Off	Off	On	X	X	X	X	X
Free Play		On	On	On	X	X	X	X	X
Bonus Jeep at 15,000 Points		X	X	X	Off	X	X	X	X
Bonus Jeep at 20,000 Points		X	X	X	On	X	X	X	X
Cocktail Table		X	X	X	X	Off	X	X	X
Upright		X	X	X	X	On	X	X	X

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY REQD.</u>	<u>DESCRIPTION</u>
1	252-0168	1	Game Base
2	253-0221	1	Logo Panel
3	253-0236	1	Game Instructions Panel
4	253-0237	11.8ft.	Woodgrain Vinyl Contact
5	281-0074-24	6	Flat Head Phillips Screw, #8-15 x 1.5
6	834-0058	1	Logic Board Assembly
7	834-0055	1	Sound Board Assembly
8	420-0568	1	FCC Decal
9	420-0613	1	Game Manual
10	420-0653	1	Front Graphic
11	734-0022	1	Upright Game Assembly

7 INDICATES RECOMMENDED SPARE PARTS--STOCK QUANTITY INDICATED TO SUPPORT 5 GAMES.





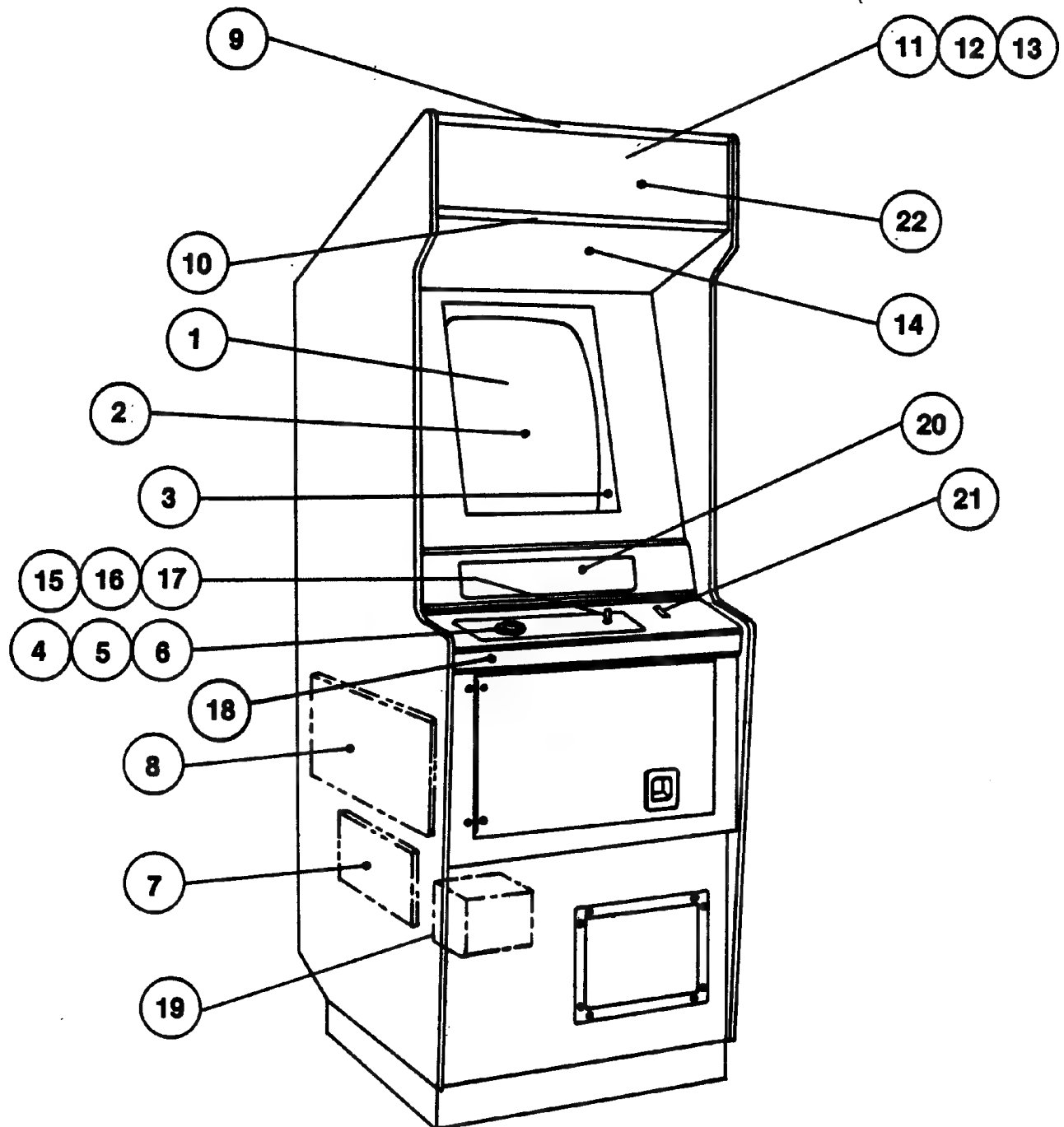
**Top Assembly  
700-0057**

## UPRIGHT GAME ASSEMBLY

DRAWING NUMBER 734-0022

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY REQD.</u>	<u>DESCRIPTION</u>
1	601-0639	1	Smoke Plexi Mask
2	601-0640	1	Color Display Assembly, 19"
3	601-0641	1	TV Mask, 19"
4	240-0108	1	Red Push Button
5	240-0110	1	Button Housing
6	509-0114	1	Micro Type Switch
7	834-0055	1	Sound Board Assembly
8	834-0058	1	Logic Board Assembly
9	601-0642	1	Upper Ornament Frame
10	601-0643	1	Lower Ornament Frame
11	390-0031	1	15W Fluorescent Lamp
12	390-0076	1	FG-1P Starter
13	182-0006	1	100V Ballast Coil
14	130-0010	1	8.0hm Speaker
15	109-0033	1	Knob
16	220-0146	1	Control Unit
17	509-0118	1	Micro Type Switch
18	220-0182	1	Control Panel
19	560-0036	1	100V-240V Transformer
20	253-0236	1	Game Instruction Panel
21	117-0037	1	Coin Entry Plate
22	253-0221	1	Logo Panel

**Upright Game Assembly  
734-0022**



## LOGIC BOARD ASSEMBLY

DRAWING NUMBER 834-0058

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY REQD.</u>	<u>DESCRIPTION</u>	<u>REF DES.</u>
1	150-0010	1	Electrolytic Capacitor, 100mf, 16V	C8
2				
3	151-0005	1	Ceramic Capacitor, 680pf, 50V	C12
4	151-0011	2	Ceramic Capacitor, .01mf, 50V	CP
10 5	151-0012	66	Ceramic Capacitor, 0.1mf, 50V	C1,C2,C4,C5, C7,C11,C13-72
6	151-0054	1	Ceramic Capacitor, .001uf	IC3, Pin 7 to Pin 9
7				
8	153-0001	4	Tantalum Capacitor, 10mf, 25V	C3,C6,C10, C1(Sub Board)
9	153-0002	1	Tantalum Capacitor, 1mf, 25V	C9
10				
11	170-0156	1	PC Board	
12				
13	211-0004	6	Test Point Connector Pin	TP1-TP6
14				
15	212-0004	2	4-Pin Male Connector	B11-B14, C15-C18

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY REQD.</u>	<u>DESCRIPTION</u>	<u>REF DES.</u>
16	212-0021	4	10-Pin Male Connector	A1-A10, D19- 20, G53-G62, H63-H72
17	212-0031	2	12-Pin Male Connector	E29-E40, F41-F52
18				
19	213-0001	16	24-Pin Dual Inline Socket	XU1-XU8, XU26-XU33
20	213-0004	11	16-Pin Dual Inline Socket	XU14,XU15, XU49,XU69- XU76
21	213-0005	1	40-Pin Dual Inline Socket	XU16
22	213-0008	1	20-Pin Dual Inline Socket	XIC4
23				
1 24	230-0009	1	15.46848 MHZ Crystal	Y1
25				
26	312-0019	2	IC 74107	IC3-IC6
27				
28	314-0001	1	IC NE555	U18
2 29	314-0006	4	IC 7474	U36,U42,U43, U65
1 30	314-0009	3	IC 7400	U23,U62,IC1
1 31	314-0010	2	IC 7410	U39,U77
2 32	314-0012	4	IC 7408	U10,U11,U12, U24

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQ'D</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
2 33	314-0015	5	IC 7404	U17, U25, U38, U68, IC3
2 34	314-0017	5	IC 74125	U51, U52, U54, U55, IC5
35	314-0020	1	IC 7430	U41
36	314-0022	1	IC 7486	U50
37	314-0029	2	IC 74157	U67, IC8
2 38	314-0035	6	IC 74151	U56-U61
39	314-0046	1	IC 74S04	U13
40	314-0047	2	IC 74174	U53, U66
2 41	314-0053	4	IC 74S175	U19-U22
42	314-0058	1	IC 74LS08	U35
43	314-0075	2	IC 74LS393	U37, U40
44	314-0077	1	IC 74LS166	U78
2 45	314-0092	2	IC 8216	U47, U48
2 46	314-0093	2	IC 74LS374	U63, U64
1 47	314-0104	3	IC 74LS138	U9, U34, IC8
1 48	314-0105	3	IC 74LS253	U44, U45, U46
49	316-1186	1	B/L E PROM	U1
	316-1185	1	B/L E PROM	U2
	316-1184	1	B/L E PROM	U3
	316-1183	1	B/L E PROM	U4
	316-1182	1	B/L E PROM	U5
	316-1181	1	B/L E PROM	U6
	316-1180	1	B/L E PROM	U7
	316-1179	1	B/L E PROM	U8
	316-1178	1	B/L E PROM	U26
	316-1177	1	B/L E PROM	U27
	316-1176	1	B/L E PROM	U28
	316-1175	1	B/L E PROM	U29

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQ'D</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
	316-1174	1	B/L E PROM	U30
	316-1173	1	B/L E PROM	U31
	316-1172	1	B/L E PROM	U32
	316-1171	1	B/L E PROM	U33
50	315-0010	8	IC 4027	U69-U76
51	315-0031	1	IC Z80	U16
52	315-0089	1	IC PAZ02	IC4
53				
54	316-0042	1	IC PROM 32 X 8 SEQ	U15
55	316-0043	1	IC PROM 32 X 8 CTL	U14
56	316-0926	1	IC Color PROM PR23	U49
57	390-0003	1	Red LED	D2
58				
59	470-0102	15	Resistor, 1K, $\frac{1}{4}$ W 5%	R11, R12, R13, R19-R29, R34
60	470-0103	1	Resistor, 10K, $\frac{1}{4}$ W, 5%	R10
61	470-0220	3	Resistor, 22 ohm, $\frac{1}{4}$ W 5%	R14, R15, R16
62	470-0221	1	Resistor, 220 ohm, $\frac{1}{4}$ W, 5%	R11
63	470-0331	5	Resistor, 330 ohm $\frac{1}{4}$ W, 5%	R3, R4, R6, R17, R18
64	470-0471	3	Resistor, 470 ohm $\frac{1}{4}$ W, 5%	R8, R46, R47
65	470-0472	17	Resistor, 4.7K, $\frac{1}{4}$ W, 5%	R9, R30-R45
66				
67	477-0002	2	Resistor Pack, 15 X 2.2K	RP1, RP2
68				
69	481-0006	3	Diode, 1N914, MA150	D1, D3, D4

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQ'D</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
70				
1 71	482-0010	1	Transistor FPE8050	Q3
2 72	482-0014	3	Transistor 2N4401	Q1, Q2, Q4
1 73	482-0232	1	Transistor, FPN3644	Q5
74	510-0043	1	6-Position Dip Switch	SW1
75	630-0015	2	IC Type Heat Sink	Items 54, 55



<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQD.</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
1	150-0009	1	CAP, ELEC., 1MF, 50V	C45
2	150-0010	4	CAP, ELEC., 100MF, 16V	CP
3	150-0031	1	CAP, ELEC., 470MF, 10V	CP
4	150-0085	1	CAP, ELEC., 10MF, 16V	C76
5	150-0100	16	CAP, ELEC., 2.2MF, 50V	C3, C6, C8, C9, C11, C13-C15, C17, C25, C27, C51, C59, C62
6	151-0011	9	CAP, CER. .01 MF	C4, C5, C7, C19- C23, C65
7	151-0012	25	CAP, CER. .1MF	CP
8	151-0005	6	CAP, CER. 680 PF	C10, C12, C16, C18, C26, C28
9	152-0001	1	CAP, FILM .1MF	C50
10	152-0024	1	CAP, FILM .033MF	C1
11	152-0027	1	CAP, FILM .047MF	C58
12	152-0032	4	CAP, FILM, .022MF	C29, C36, C43, C60
13	152-0033	3	CAP FILM .01MF	C39, C48, C63
14	152-0037	1	CAP, FILM .068MF	C61
15	152-0051	1	CAP FILM .0033MF	C40
16	152-0117	1	CAP, FILM 6800PF	C44
17	153-0003	5	CAP, TANT, 2.2MF, 25V	C30, C31, C41, C42 C77
18	153-0016	1	CAP, TANT. .1MF, 35V	C72
19	153-0026	17	CAP, TANT. 22MF, 16V	CP
20	153-0028	2	CAP. TANT. .22MF, 35V	C32, C33
21	153-0031	2	CAP. TANT. 3.3MF, 25V	C54, C55

## ASSEMBLY SOUND BOARD

DRAWING NUMBER 834-0055

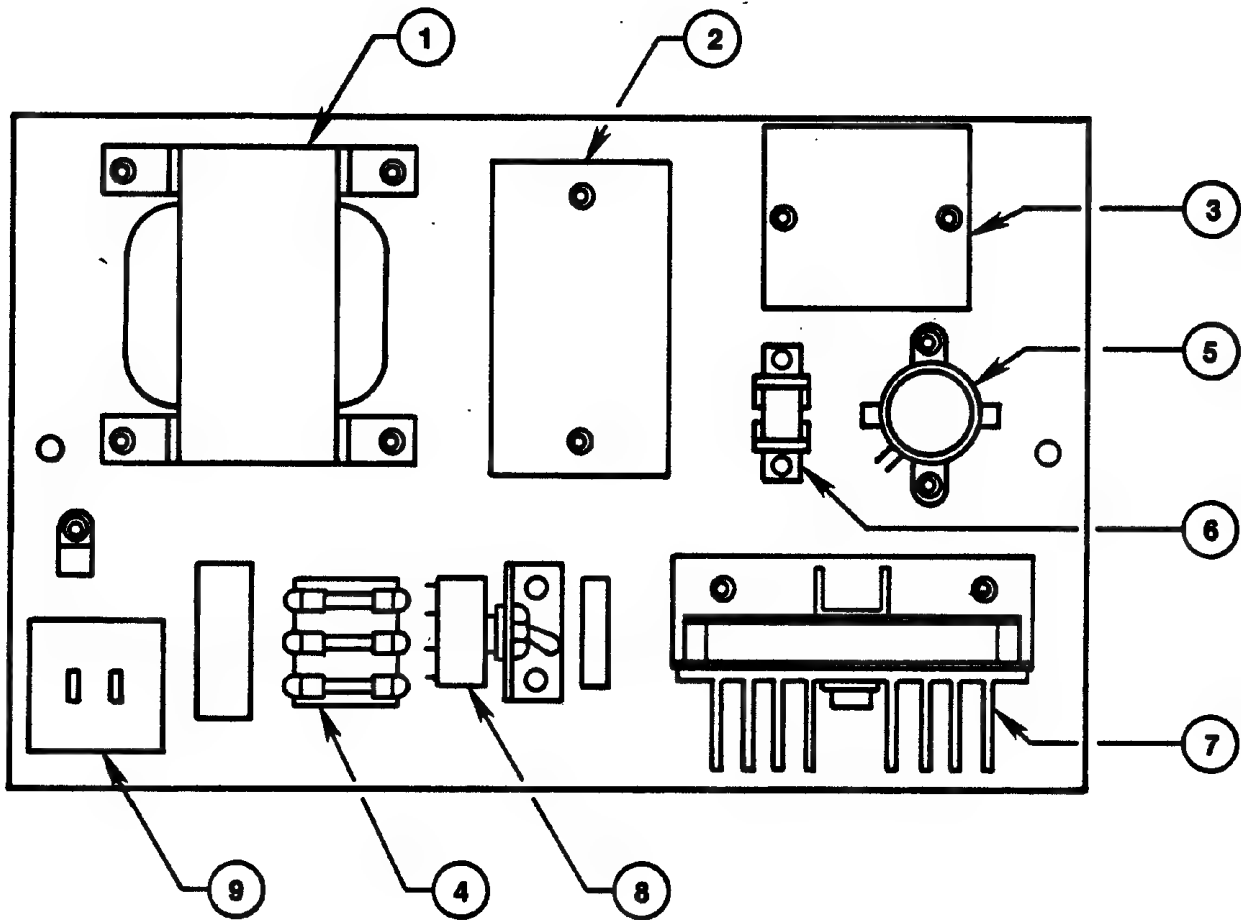
<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQD.</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
22	153-0048	1	CAP, TANT, 100MF, 16V	C24
23	153-0049	3	CAP, TANT. 47MF, 16V	C66, C67, C78
24	171-0123	1	PCB, OSCILLATOR	
1 25	312-0209	3	I.C. MB4391	IC4, IC5, IC20
2 26	313-0034	8	I.C. LM324	IC9, IC21-IC25, IC27, IC38
2 27	314-0001	16	I.C. NE555	IC1, IC6-IC8, IC10-IC19, IC28, IC31
28	314-0058	1	I.C. 74LS08	IC29
29	314-0062	2	I.C. 74LS74	IC30, IC32
1 30	314-0080	4	I.C. 74LS123	IC33-IC35, IC37
31	314-0146	1	I.C. SN7416	IC36
32				
33				
34	470-0102	17	RES. 1K, $\frac{1}{4}$ W, 5%	R10, R20, R76, R109, R135, R136, R139, R140, R142, R145, R147, R148, R150-R152, R154, R156
35	470-0103	23	RES. 10K, $\frac{1}{4}$ W, 5%	R9, R16, R19, R21- R25, R27-R31, R33, R34, R36, R43, R86, R110, R112, R119, R167, R168
36	470-0104	5	RES, 100K, $\frac{1}{4}$ W, 5%	R53, R68, R88, R95, R100
37	470-0105	1	RES, 1M, $\frac{1}{4}$ W, 5%	R40
38	470-0153	10	RES. 15K, $\frac{1}{4}$ W, 5%	R45, R61, R69, R78, R85, R93, R101, R122, R131, R134

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQD.</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
39	470-0154	1	RES. 150K, $\pm$ W, 5%	R92
40	470-0221	1	RES. 220 OHM, $\pm$ W, 5%	R44
41	470-0222	1	RES. 2.2K, $\pm$ W, 5%	R37
42	470-0223	16	RES. 22K, $\pm$ W, 5%	R1-R8, R38, R41, R96, R99, R113, R114, R133, R137
43	470-0224	3	RES. 220K, $\pm$ W, 5%	R54, R67, R132
44	470-0273	3	RES. 27K, $\pm$ W, 5%	R98, R111, R163
45	470-0303	11	RES. 30K, $\pm$ W, 5%	R11, R32, R35, R46, R62, R70 R79, R84, R126, R130, R169
46	470-0332	1	RES. 3.3K, $\pm$ W, 5%	R18
47	470-0333	3	RES. 33K, $\pm$ W, 5%	R26, R102, R153
48	470-0363	1	RES. 36K, $\pm$ W, 5%	R42
49	470-0393	1	RES. 39K, $\pm$ W, 5%	R120
50	470-0471	6	RES. 470 OHM, $\pm$ W, 5%	R89, R97, R103, R106, R159, R160
51	470-0473	9	RES. 47K, $\pm$ W, 5%	R121, R138, R141, R143, R144, R146, R149, R155, R171
52	470-0474	15	RES. 470K, $\pm$ W, 5%	R51, R75, R87, R90, R91, R94, R104, R105, R107, R108, R116, R161, R162, R164, R165,
53	470-0512	5	RES. 5.1K, $\pm$ W, 5%	R14, R17, R52, R60, R77
54	470-0513	34	RES 51K, $\pm$ W, 5%	R12, R13, R15, R39, R47-R50, R55-R58, R63-R66, R71-R74, R80-R83, R115, R117, R118, R123-R125, R129, R157, R158

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY. REQD.</u>	<u>DESCRIPTION</u>	<u>REF. DESG.</u>
55	470-0563	1	RES. 56K, $\frac{1}{4}$ W, 5%	R127
56	470-0564	1	RES. 560K, $\frac{1}{4}$ W, 5%	R59
57	470-0123	1	RES. 12K, $\frac{1}{4}$ W, 5%	R166
58	475-0005	7	VAR, RES. 200K	VR1-VR4, VR6-VR8
59	475-0009	1	VAR. RES. 500K	VR5
2 60	481-0031	6	DIODE MA150	D1-D6
4 61	482-0227	16	TRANS. 2SC458	TR1-TR16

# POWER SUPPLY ASSEMBLY

<u>ITEM NO.</u>	<u>PART NO.</u>	<u>QTY REQD.</u>	<u>DESCRIPTION</u>
1	560-0056	1	Power Transformer, 90-120V
2	601-0624	1	Voltage Regulator Assembly
3	110-0001	1	Power Amplifier, 5W
3 4	514-0032	1	2A Fuse
3	514-0034	2	5A Fuse
5	150-0061	1	Condenser, 10000uf, 16V
1 6	481-0049	1	Rectifier, Silicon Diode
7	601-0612	1	Regulator Unit
1	481-0065	1	Rectifier, Silicon Diode
1	481-0042	1	Rectifier, Silicon Diode
1	313-0012	1	IC uA 7805 UC
1	313-0014	1	IC uA 7812 UC
1	312-0070	1	IC uA 78M12 UC
8	509-0115	1	Toggle Switch
9	601-0484	1	AC Outlet

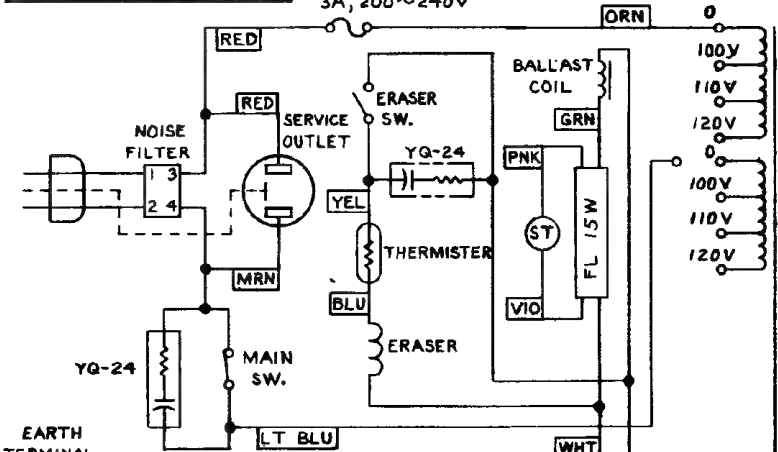


**Power Supply**

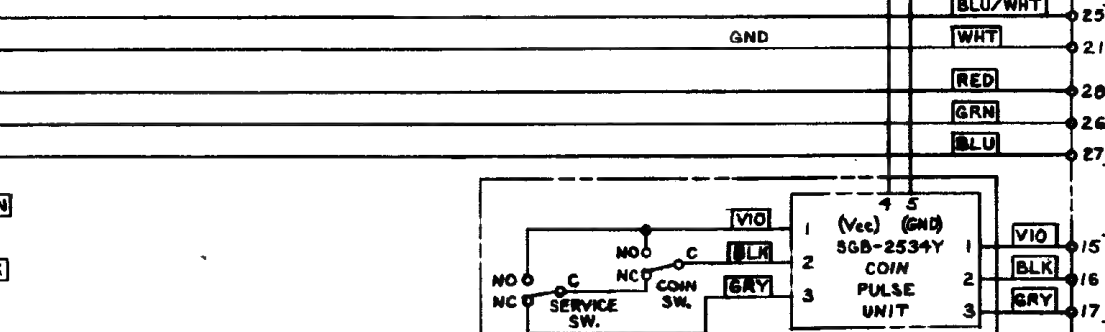
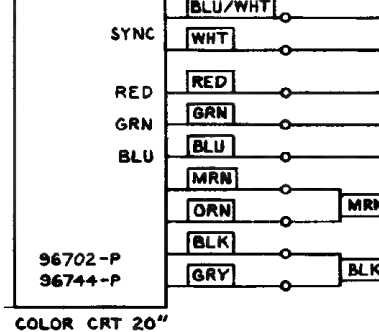
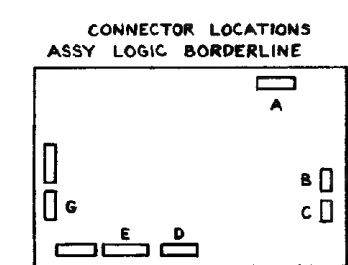
1-2-3-4 COINS 1 PLAY DIP SW. ADJ.

DIP-SWITCH NR	1	2	3	4
1 COIN	ON	OFF	OFF	OFF
2 COIN	OFF	ON	OFF	OFF
3 COIN	OFF	OFF	ON	OFF
4 COIN	OFF	OFF	OFF	ON

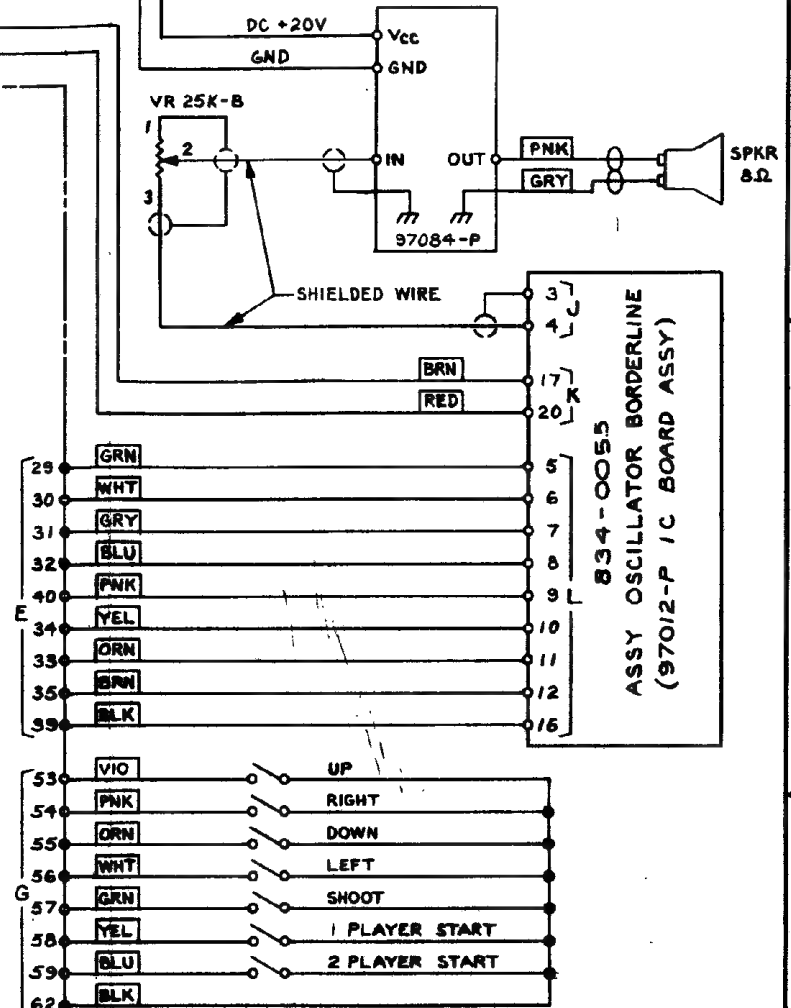
5A, 100~120V  
3A, 200~240V



FRONT PANEL COIN CHUTE BRACKET

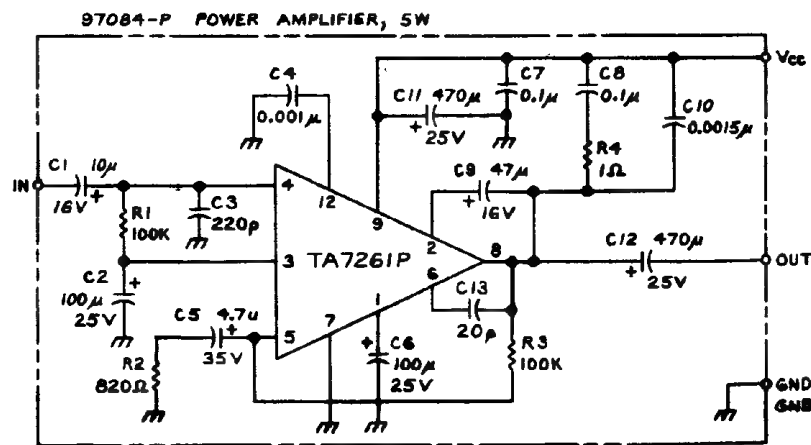


834-0058 ASSY LOGIC BORDERLINE  
(E-97038-P IC BOARD ASSY)

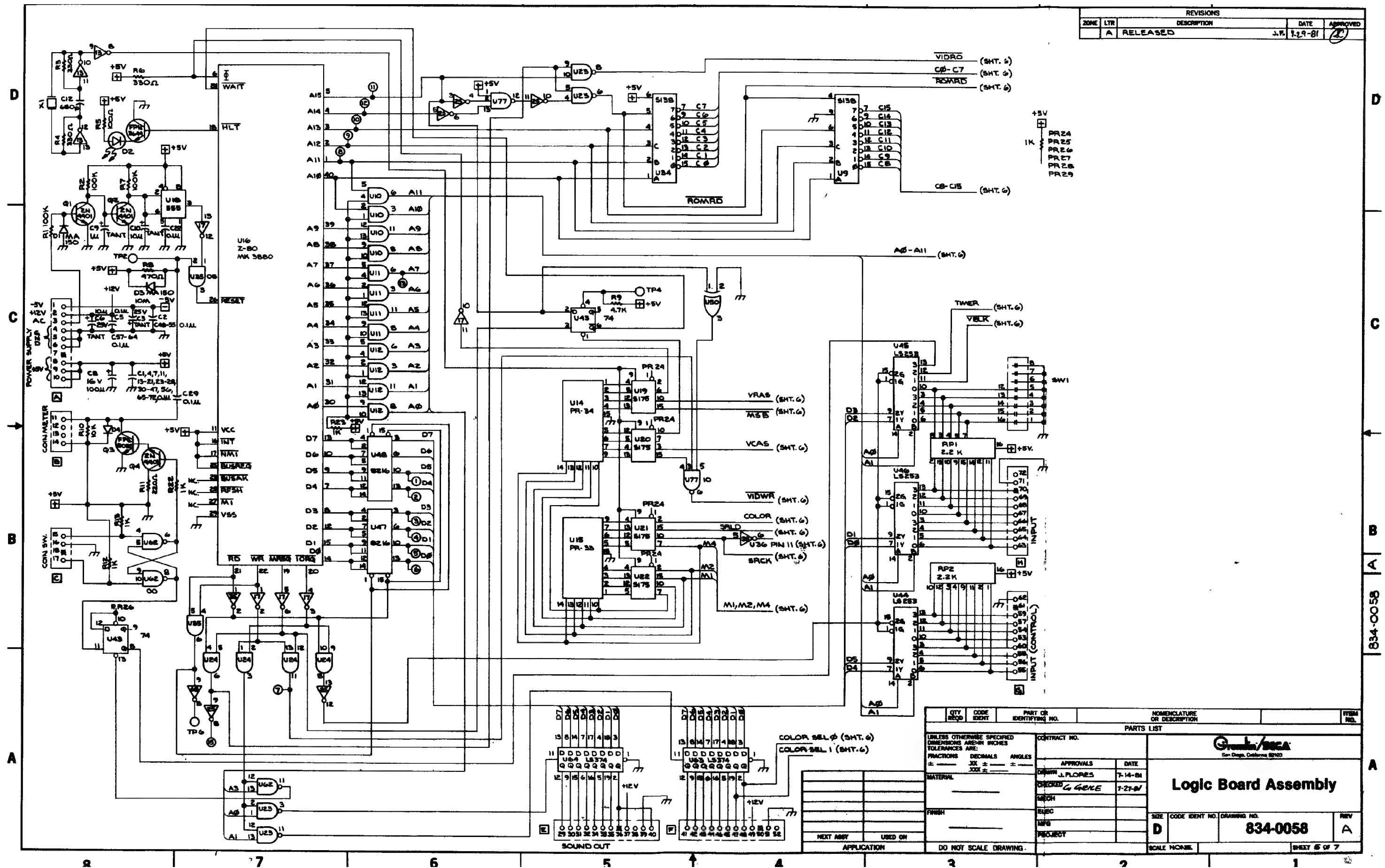


TRANSFORMER CONNECTIONS

100V	120V	200V	220V	230V	240V
0 100 110 120	0 100 110 120	0 100 110 120	0 100 110 120	0 100 110 120	0 100 110 120

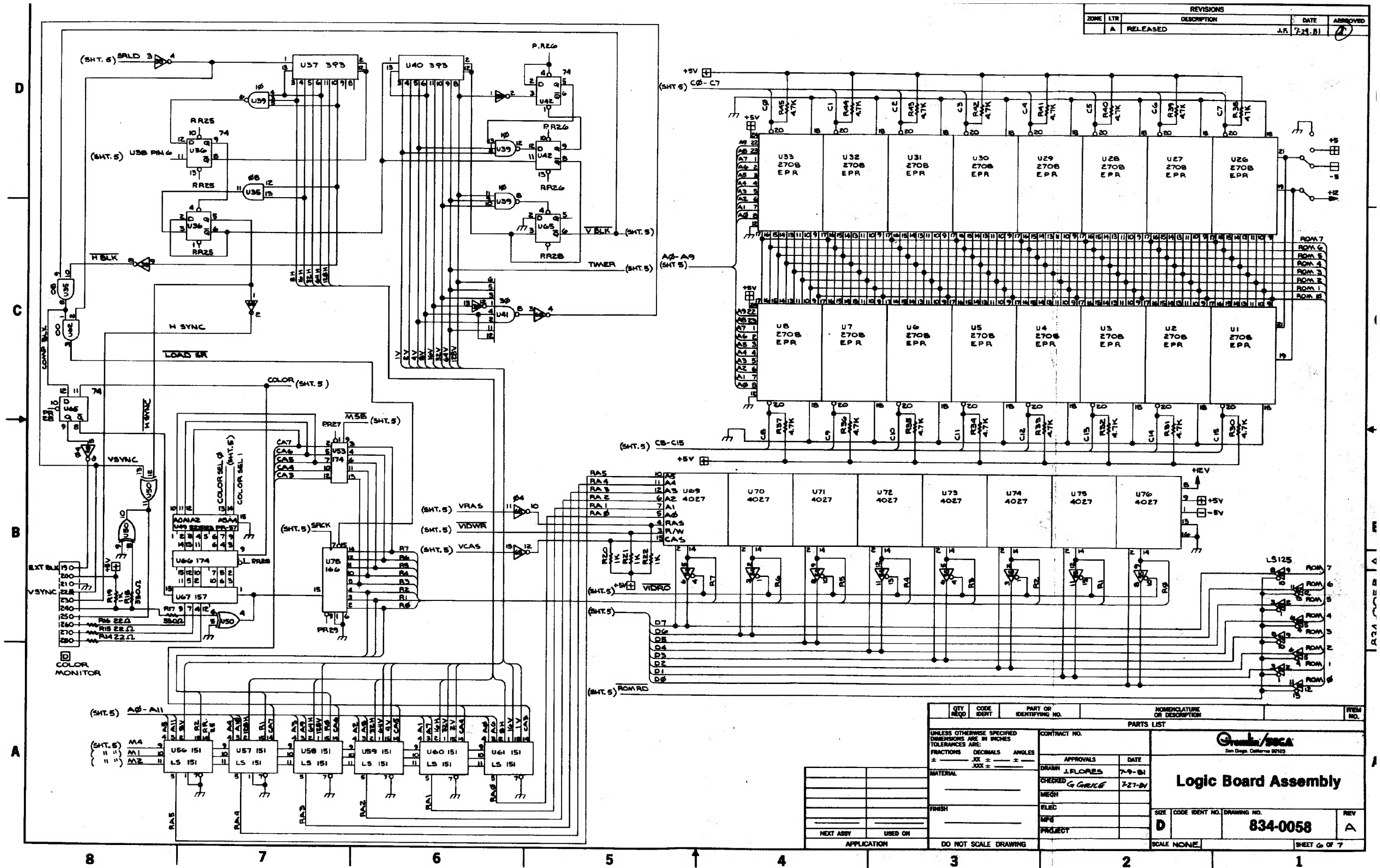


QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		
FRACTIONS DECIMALS ANGLES		APPROVALS DATE		
± .01 ± .005 ± .001		DRAWN CATELL 7-27-81		
MATERIAL		CHECKED G. GRICE 7-27-81		
FINISH		ELEC		
NEXT ASSY USED ON		SIZE CODE IDENT NO. DRAWING NO.		
APPLICATION		D 700-0057		
DO NOT SCALE DRAWING		REV A		
		SCALE NONE		
		SHEET 2 OF 2		





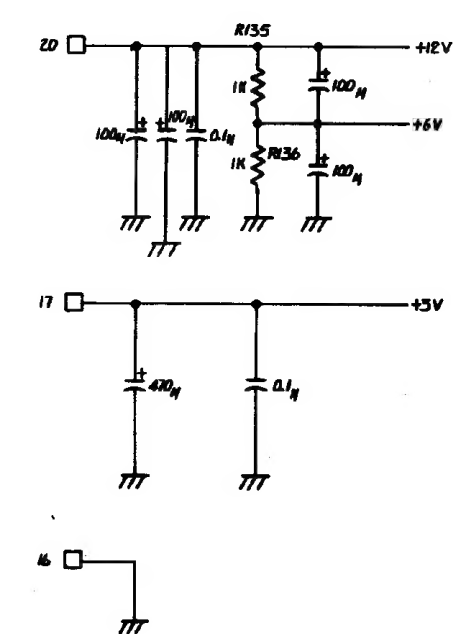
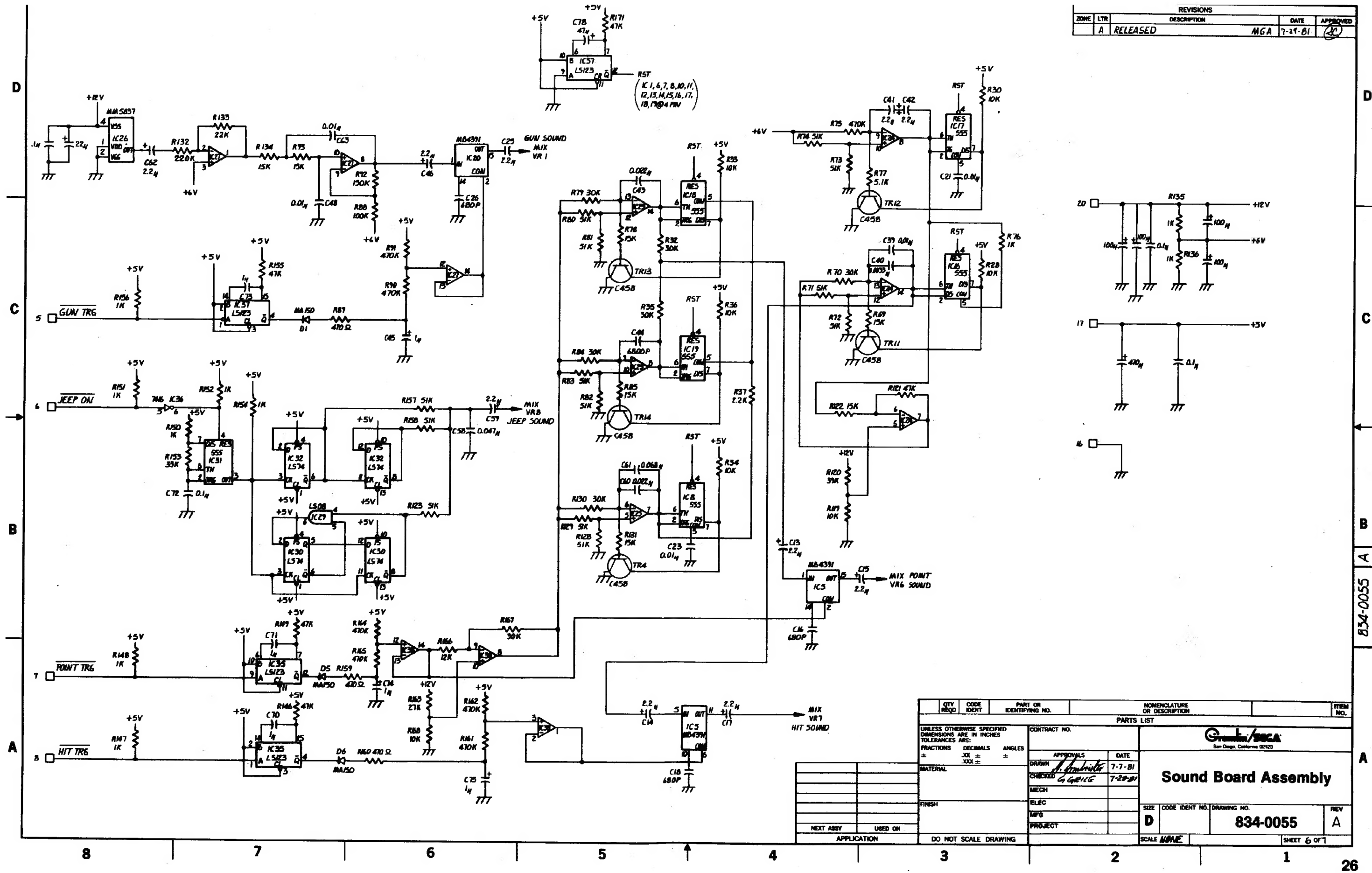
REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
A	RELEASED		J.F. 7-21-81



QTY	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:				
FRACTIONS	DECIMALS	ANGLES		
±	JXX ±	±		
MATERIAL				
FINISH				
DO NOT SCALE DRAWING				
CONTRACT NO.				
APPROVALS				
DATE				
DRAWN J.FLORES 7-9-81				
CHECKED G. GARCIA 7-21-81				
MECH				
ELEC				
MPG				
PROJECT				
<div> <div> <b>Logic Board Assembly</b> </div> <div> <b>834-0058</b> </div> </div>				
<div> <div> <b>D</b> </div> <div> <b>834-0058</b> </div> </div>				
<div> <div> <b>SCALE NONE</b> </div> <div> <b>SHEET 6 OF 7</b> </div> </div>				



REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
A	RELEASED	MGA	7-29-81



QTY	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES				
TOLERANCES ARE:				
FRACTIONS	DECIMALS	ANGLES		
±	±	±		
MATERIAL				
FINISH				
DO NOT SCALE DRAWING				
CONTRACT NO.				
APPROVALS				
DATE				
DRAWN				
CHECKED				
MECH				
ELEC				
MFG				
PROJECT				
SIZE				
CODE IDENT NO.				
DRAWING NO.				
REV				
834-0055				
SHEET 6 OF 7				

